

What is claimed is:

1. An overlapped-sheet detection apparatus comprising:  
a conveying path on which sheets are conveyed;

5 a forwarding roller provided at said conveying path to  
forward said sheets in a conveying direction;

a shifting roller provided opposite to said forwarding  
roller to shift said sheets back to a reverse direction of said  
conveying direction if said sheets are overlapped;

10 a motor for supplying said shifting roller with driving  
torque to shift said sheets back to said reverse direction of said  
conveying direction;

a rotation detection unit for detecting a rotation state of  
said shifting roller; and

15 a discriminator for judging from an output of said  
rotation detection unit that said sheets are overlapped.

2. An overlapped-sheet detection apparatus according to  
Claim 1, further comprising;

20 an arm for depressing said forwarding roller with  
pinch-pressure through said shifting roller, said arm having one  
end portion provided at a rotation axis of said shifting roller and  
another end portion rotationally provided at a fixed axis; and

a spring for rotating said arm around said fixed axis to  
25 depress said shifting roller against said forwarding roller with said  
pinch-pressure in order for said forwarding roller to cooperatively

rotate said shifting roller when said sheets are not overlapped.

3. An overlapped-sheet detection apparatus according to Claim 2, wherein said arm transmits said driving torque to said  
5 shifting roller.

4. An overlapped-sheet detection apparatus according to Claim 1, further comprising;

an arm for depressing said shifting roller with  
10 pinch-pressure through said forwarding roller, said arm having one end portion provided at a rotation axis of said forwarding roller and another end portion rotationally provided at a fixed axis; and

a spring for rotating said arm around said fixed axis to depress said forwarding roller against said shifting roller with said  
15 pinch-pressure.

5. An overlapped-sheet detection apparatus according to Claim 1, wherein said rotation detection unit includes an encoder and said discriminator compares an output of said encoder with  
20 predetermined reference rotation speed and reference time to judge if said sheets are overlapped.

6. An overlapped-sheet detection apparatus according to Claim 1, further comprising a controller for stopping transmitting  
25 said driving torque from said motor to said shifting roller after a lapse of predetermined time after when said discriminator judges

that said sheets are overlapped.

7. An overlapped-sheet detection apparatus comprising:

a conveying path on which sheets are conveyed;

5 a forwarding roller provided at said conveying path to forward said sheets in a conveying direction;

a shifting roller provided opposite to said forwarding roller to shift said sheets back to a reverse direction of said conveying direction if said sheets are overlapped ;

10 a motor for supplying said shifting roller with driving torque to shift said sheets back to said reverse direction of said conveying direction;

an entrance sensor disposed closer to an entrance of said conveying path than said forwarding roller to measure a first  
15 length of said sheets along said conveying direction;

an exit sensor disposed closer to an exit of said conveying path than said forwarding roller to measure a second length of said sheets along said conveying direction; and

an overlapped-sheet detection unit for detecting from a  
20 difference between said first and second lengths supplied from said entrance and exit sensors that said sheets are overlapped.

8. An overlapped-sheet detection apparatus according to Claim 7, wherein said overlapped-sheet detection unit judges that  
25 said sheets are overlapped if the difference is greater than a predetermined value.

9. An overlapped-sheet detection apparatus comprising:  
a forwarding roller rotating while making contact with  
sheets to forward the sheets;

5 a shifting roller provided at a position where said shifting  
roller and said forwarding roller pinch at said sheets,

said shifting roller being configured to shift said sheets if  
said sheets are overlapped and to follow a rotation of said  
forwarding roller if said sheets are not overlapped;

10 driving torque means for supplying said shifting roller  
with driving torque to shift said sheets;

detection means for detecting rotation states of said  
shifting roller;

discrimination means for judging from said rotation  
15 states detected by said detection means that said sheets are  
overlapped; and

control means for controlling said driving torque means to  
transmit less driving torque than in ordinary cases when said  
discrimination means judges that said sheets are overlapped.

20 10. An overlapped-sheet detection apparatus according to  
Claim 9, wherein said control means controls said driving torque  
means to stop transmitting driving torque when said  
discrimination means judges that said sheets are overlapped.

25 11. An overlapped-sheet detection apparatus according to

Claim 9 or 10, further comprising rear edge detection means for detecting a rear edge portion of said sheets when said sheets pass through a position where said forwarding roller is provided opposite to said shifting roller, wherein said control means controls  
5 said driving torque means to transmit less driving torque than in ordinary cases when said discrimination means judges that said sheets are overlapped and said driving torque means to return to transmission of driving torque in ordinary cases when said rear edge detection means detects the rear edge portion of said sheets.

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12. An overlapped-sheet detection apparatus comprising:  
a forwarding roller rotating while making contact with sheets to forward the sheets in a conveying direction;

a shifting roller provided at a position where said shifting  
15 roller and said forwarding roller pinch at said sheets,

said shifting roller being configured to shift said sheets if said sheets are overlapped and to follow a rotation of said forwarding roller if said sheets are not overlapped;

driving torque means for supplying said shifting roller  
20 with driving torque to shift said sheets in a rotation direction and with returning torque in another direction which is the reverse of said rotation direction;

detection means for detecting rotation states of said shifting roller;

25 discrimination means for judging from said rotation states detected by said detection means whether said sheets are

overlapped or not;

measurement means for measuring a shift of said sheets made by said shifting roller from said rotation states detected by said detection means; and

5 control means for controlling said driving torque means to transmit said returning torque to said shifting roller so that said sheets are shifted in said direction which is the reverse of said conveying direction in accordance with said shift measured by said measurement means.

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13. An overlapped-sheet detection apparatus according to Claim 12, wherein said control means controls said driving torque means to transmit less driving torque than in ordinary cases when said discrimination means judges that said sheets are overlapped  
15 and to transmit said returning torque to said shifting roller so that said sheets are shifted in said direction which is the reverse of said conveying direction in accordance with said shift measured by said measurement means.

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14. A method of detecting overlapped sheets comprising:

rotating a forwarding roller while said forwarding roller makes contact with sheets to forward the sheets in a conveying direction;

25 providing a shifting roller at a pinch position where said shifting roller and said forwarding roller pinch at said sheets;

providing said shifting roller with shifting torque to shift

said sheets if said sheets are overlapped;

allowing said shifting roller to follow a rotation of said forwarding roller if said sheets are not overlapped;

detecting rotation states of said shifting roller to which  
5 said shifting torque is provided while conveying said sheets;

judging that said sheets are overlapped when said rotation states are changed; and

transmitting less torque than said shifting torque to said shifting roller so that said sheets are shifted less.

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15. A method of detecting overlapped sheets according to Claim 14, further comprising returning said less torque to said shifting torque when said sheets pass through said pinch position of said forwarding and shifting rollers.

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16. A method of detecting overlapped sheets comprising:

rotating a forwarding roller while said forwarding roller makes contact with sheets to forward the sheets in a conveying direction;

20 providing a shifting roller at a pinch position where said shifting roller and said forwarding roller pinch at said sheets;

providing said shifting roller with shifting torque to shift said sheets if said sheets are overlapped;

allowing said shifting roller to follow a rotation of said  
25 forwarding roller if said sheets are not overlapped;

detecting rotation states of said shifting roller to which

said shifting torque is provided while conveying said sheets;

judging that said sheets are overlapped when said rotation states are changed;

measuring a shift of said sheets made by said shifting  
5 roller; and

transmitting returning torque based on said shift measured to said shifting roller to shift said sheets in a reverse direction of said conveying direction.

10 17. A method of detecting overlapped sheets according to Claim 16, wherein said transmitting further provides said shifting roller with less shift[ing torque?] so that said sheets are less shifted and then provides said returning torque based on said shift measured to said shifting roller to shift said sheets in a reverse  
15 direction of the conveying direction.

18. An overlapped-sheet detection apparatus comprising:  
a first forwarding roller rotating while making contact with sheets to forward the sheets in a conveying direction on a  
20 conveying path;

a shifting roller provided at a position where said shifting roller and said first forwarding roller pinch at said sheets,

said shifting roller being configured to shift said sheets if said sheets are overlapped and to follow a rotation of said first  
25 forwarding roller if said sheets are not overlapped;

driving torque means for supplying said shifting roller



with driving torque to shift said sheets;

detection means for detecting rotation states of said shifting roller;

discrimination means for judging from said rotation  
5 states detected by said detection means whether said sheets are overlapped or not;

a second forwarding roller provided closer to an entrance than to said first forwarding roller, said second forwarding roller rotating while making contact with sheets to forward the sheets  
10 between said first forwarding and shifting rollers; and

depression means for depressing said second forwarding roller against said sheets.

19. An overlapped-sheet detection apparatus according to  
15 Claim 18, wherein said first and second forwarding rollers are disposed in a distance defined between axes thereof set to be shorter along the conveying direction than the shortest one of said sheets.

20 20. An overlapped-sheet detection apparatus according to Claim 18, wherein said depression means transmits a conveying force of said second forwarding roller to said sheets and depresses said second forwarding roller to allow the overlapped sheets to slide.

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21. An overlapped-sheet detection apparatus according to

Claim 20, wherein said depression means is made of a plastic resin plate spring.

22. An overlapped-sheet detection apparatus according to  
5 Claim 21, wherein said plastic resin spring plate has a convexly curved portion that crosses over the conveying path and is projected into said second forwarding roller.

23. An overlapped-sheet detection apparatus according to  
10 Claim 18, further comprising a pinch roller provided at a position where said second forwarding roller and said pinch roller pinch at said sheets to depress said second forwarding roller detachably with a pinch-pressure.

15 24. An overlapped-sheet detection apparatus comprising:  
a forwarding roller rotating while making contact with sheets to forward the sheets in a conveying direction on a conveying path;

a shifting roller provided at a position where said shifting  
20 roller and said forwarding roller pinch at said sheets,

said shifting roller being configured to shift said sheets if said sheets are overlapped and to follow a rotation of said forwarding roller if said sheets are not overlapped;

driving torque means for supplying said shifting roller  
25 with driving torque to shift said sheets;

a first sensor provided closer to an entrance than to said

forwarding roller to detect a rear edge portion of said sheets in the conveying direction;

a second sensor provided between said first sensor and said forwarding roller to detect the rear edge portion of said sheets  
5 in the conveying direction; and

discrimination means for judging whether said sheets are overlapped or not from a period of time taken between detection of the rear edge portion by said first and that of the rear edge portion by second sensor.

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25. An overlapped-sheet detection apparatus comprising:

a forwarding roller rotating while making contact with sheets to forward the sheets in a conveying direction on a conveying path;

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a shifting roller provided at a position where said shifting roller and said forwarding roller pinch at said sheets,

said shifting roller being configured to shift said sheets if said sheets are overlapped and to follow a rotation of said forwarding roller if said sheets are not overlapped;

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driving torque means for supplying said shifting roller with driving torque to shift said sheets;

detection means for detecting rotation speeds of said shifting roller; and

discrimination means for judging that said sheets are  
25 overlapped when a difference between said rotation speed of said shifting roller and that of said forwarding roller is greater than a

threshold value.

26. An overlapped-sheet detection apparatus comprising:

5 a forwarding roller rotating while making contact with sheets to forward the sheets in a conveying direction on a conveying path;

a shifting roller provided at a position where said shifting roller and said forwarding roller pinch at said sheets,

10 said shifting roller being configured to shift said sheets if said sheets are overlapped and to follow a rotation of said forwarding roller if said sheets are not overlapped;

driving torque means for supplying said shifting roller with driving torque to shift said sheets;

15 detection means for detecting rotation speeds of said shifting roller;

first discrimination means for judging that said sheets are overlapped when a difference between said rotation speed of said shifting roller and that of said forwarding roller is greater than a threshold value;

20 a first sensor provided closer to an entrance of the conveying path than to said forwarding roller to detecting a rear edge portion of said sheets in said conveying direction;

a second sensor provided between said first sensor and said forwarding roller to detect said rear edge portion of said sheets  
25 in said conveying direction; and

second discrimination means for judging whether said

sheets are overlapped or not from a period of time taken between detection of the rear edge portion by said first and that of said rear edge portion by second sensor.

5           27. An overlapped-sheet detection apparatus according to Claim 26, wherein said first sensor is disposed in a distance defined between a position where said forwarding and shifting rollers are opposite each other and said first sensor is set to be shorter along the conveying direction than the shortest one of said sheets.

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